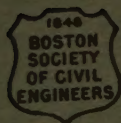


JOURNAL OF THE
BOSTON SOCIETY
OF
CIVIL ENGINEERS



JANUARY - 1933

VOLUME XX

NUMBER 1

BOSTON SOCIETY OF CIVIL ENGINEERS

OFFICERS, 1932-1933

PRESIDENT

RALPH W. HORNE

VICE-PRESIDENTS

ARTHUR W. DEAN

(Term expires March, 1933)

JOHN B. BABCOCK, 3d

(Term expires March, 1934)

SECRETARY

EVERETT N. HUTCHINS

TREASURER

KARL R. KENNISON

DIRECTORS

GORDON M. FAIR

ARTHUR D. WESTON

(Term expires March, 1933)

JOHN C. MOSES

EDWARD WRIGHT

(Term expires March, 1934)

PAST PRESIDENTS

FRANK E. WINSOR

LEWIS E. MOORE

HARRY E. SAWTELL

SANITARY SECTION

STUART E. COBURN, Chairman

FRANK L. FLOOD, Clerk

DESIGNERS SECTION

LAWRENCE G. ROPES, Chairman

HERMAN G. DRESSER, Clerk

HIGHWAY SECTION

FRANCIS T. McAVOY, Chairman

ARTHUR P. RICE, Clerk

NORTHEASTERN UNIVERSITY SECTION

ANTHONY TEDESCO, Chairman

A. BRUCE SCHOW, Clerk

Editor — EVERETT N. HUTCHINS

715 Tremont Temple, Boston

JOURNAL OF THE BOSTON SOCIETY OF CIVIL ENGINEERS

Volume XX

JANUARY, 1933

Number 1

CONTENTS

PAPERS AND DISCUSSIONS

	PAGE
New Incinerators at Washington, D. C. <i>Harrison P. Eddy, Jr.</i>	1

OF GENERAL INTEREST

Memoirs:

Herbert Neal Cheney	14
Edwin Howland Lincoln	14
Proceedings of the Society	15

Published Monthly, except July and August, by the Society
715 Tremont Temple, Boston, Massachusetts

Subscription Price, \$4.00 a Year (10 Copies)
50 Cents a Copy

Copyright, 1933, by the Boston Society of Civil Engineers.
Entered as second-class matter, January 15, 1914, at the Post Office
at Boston, Mass., under Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in
Section 1103, Act of October 3, 1917, authorized on July 16, 1918.

*The Society is not responsible for any statement made or opinion
expressed in its publications.*

BOSTON
WRIGHT & POTTER PRINTING COMPANY
32 DERNE STREET

112707

JOURNAL OF THE BOSTON SOCIETY OF CIVIL ENGINEERS

Volume XX

JANUARY, 1933

Number 1

NEW INCINERATORS AT WASHINGTON, D. C.

BY HARRISON P. EDDY, JR.*

(Presented at a meeting of the Boston Society of Civil Engineers on September 21, 1932)

HISTORY OF PROJECT

FOR many years the garbage of Washington has been converted into grease and tankage at the city's reduction plant at Cherry Hill, Va. Ashes and street sweepings have been used as filling material on city dumps.

Until recently rubbish, or, as it is called locally, "trash," has been delivered to the Mt. Olivet Road salvage plant, where any articles of value have been separated by hand-picking from a belt conveyor and sold, and the tailings from the conveyor have been burned in two furnaces.

Both reduction and salvage plants originally were operated by private contractors, but in recent years the city has operated both plants.

The rubbish plant was built in 1919. Following the failure of the contractor on account of the fall in market prices for salvaged goods shortly after the war, its operation was taken over and the property was leased by the city in 1920.

The garbage reduction plant was built about 1900. It was operated by the Washington Fertilizer Company until sometime during the war, when operation was taken over by the city.

The capacity of the furnaces at the rubbish plant was quite inadequate to burn the rubbish produced in the city. A few years ago the plant was seriously damaged by fire. Since then, due to overloading, high temperatures and to the methods of construction, the arches

* Of Metcalf & Eddy, Engineers, Boston, Mass.

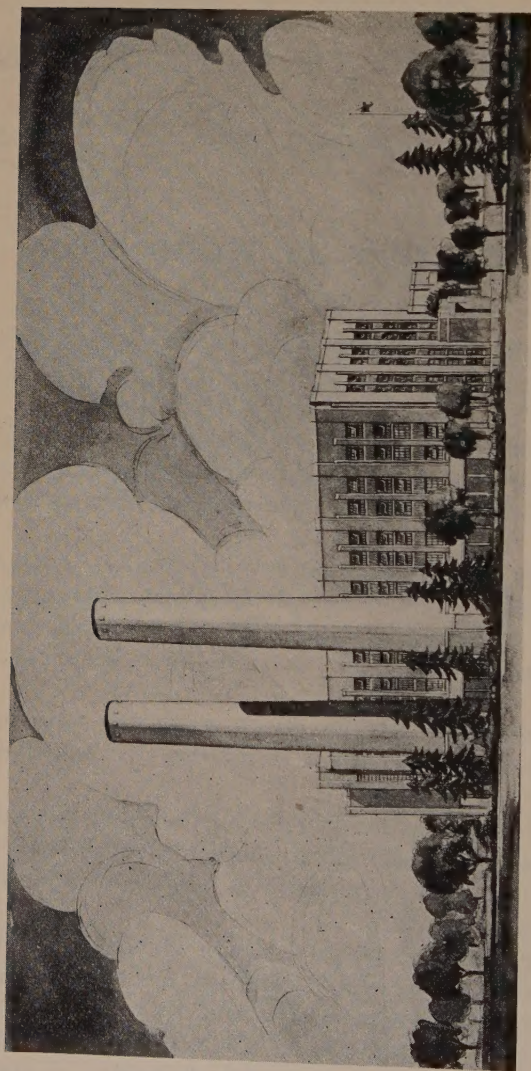


FIG. 1.—O STREET INCINERATOR
Level site

of the furnaces have collapsed from time to time, and their reconstruction has been necessary.

Large volumes of rubbish, therefore, were burned on various dumps in the District of Columbia. Finally the District Engineer of the United States Army ordered that such burning should cease on dumps under his jurisdiction. Later, similar orders were issued by the Commissioners of the District, on account of the nuisance arising from this practice.

Closing of dumps in the District of Columbia, together with the inadequacy of the rubbish plant, necessitated the dumping of rubbish in Virginia, principally at the Washington airport just across the Potomac from the city. The practice here has been to accumulate huge heaps of rubbish and to set fire to them when the wind was favorable. Unfortunately a shifting wind would send the smoke back to the city.

From 1922 to 1929 attempts were made to obtain from the United States Congress an appropriation for the construction of a new incinerator. Finally, on March 4, 1929, an act was passed authorizing an appropriation for the construction of two incinerators for burning "combustible refuse including street sweepings." Funds for construction were appropriated the following year.

Bids were received on March 17, 1931, which provided for the bidding contractors to design the building and furnaces, subject to comprehensive specifications issued by the District. Ten bids were received for both plants, the lowest conforming bid amounting to \$594,000, for the two plants. Reference of the bids to the Comptroller General of the United States resulted in a decision that the contract must be re-advertised on the grounds that it was illegal to let a contract on the basis of designs prepared by each bidder. It was then decided by the Commissioners that, in order to comply with the Comptroller General's ruling, it would be necessary for the District to prepare complete detail designs of furnaces, buildings and appurtenances such that every bidder would quote upon the same plant. Accordingly new plans and specifications were prepared for both plants, for which twenty-four bids were received on December 8, 1931.

The former appropriation lapsed at the end of the 1931 fiscal year, so that the contracts could not be awarded until February 3, 1932, when funds had been made available by the 1932 Congress. The low bids received the second time amounted to \$104,000 less than the low conforming bids the first time, and were accepted.

After receipt of the second set of bids another bidder appealed to the Comptroller General on the grounds that its proprietary type of equipment had been excluded, but the Comptroller General ruled against

this claim. At about this time a former bidder threatened suit for patent infringement, but, after obtaining legal advice, the contracts were let and construction started. No suit as yet has been brought.

SELECTION OF SITES

The municipal forces collect rubbish only from private dwellings including apartment houses of four families or less. In addition to this a substantial volume is produced by business houses, hotels, large apart-

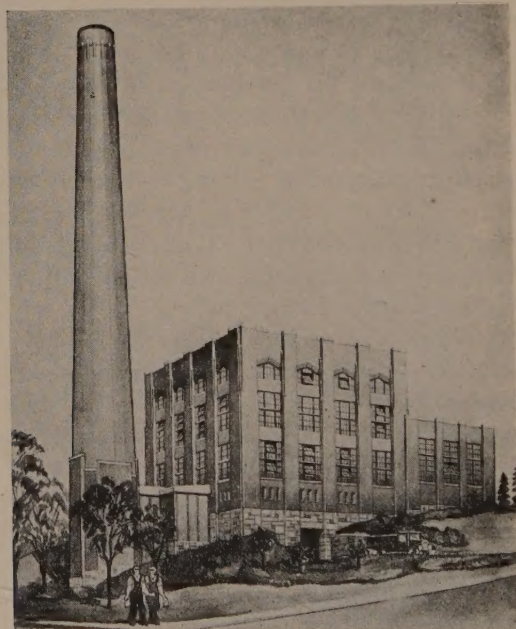


FIG. 2. — GEORGETOWN INCINERATOR
Side hill location

ment houses, etc. By an act of Congress in 1930, combustible refuse from suburban communities in Maryland and Virginia also may be burned in the new incinerators.

Records of the volume of material collected by the District were available, and careful estimates were made of the volume which would be delivered to the plants by private collectors. The municipal collection was estimated to be equivalent to 307 pounds per capita per year. From experience elsewhere it was assumed that the suburban production would not exceed 200 pounds per capita, of which not more than 100 pounds per capita would be delivered to the Washington incinerators.

The incinerators were designed to serve an estimated population of 621,000 persons, and to have a total capacity of 595 tons per day. The decision as to the capacity of each of the two plants was based upon consideration of the cost of haul and the geographical trend of the growth in population. These studies indicated that the plant on O Street, in the southeast section of the city, should have approximately twice the capacity of that in Georgetown.

Accordingly five furnaces have been built in the O Street plant and two in the Georgetown plant, one of the five at O Street being held in reserve. This arrangement provides flexibility in operation.

The site for the O Street incinerator is in an area zoned for industrial use. It is across the street from the sewage pumping station, the sewer department garage and storage yard and a lumber company, and near the United States Navy Yard and the new Buzzards Point power plant of the Potomac Electric Power Company.

The site for the Georgetown incinerator is in an area zoned for industrial use, but residential Georgetown is in close proximity to industrial Georgetown. Across the street is an Episcopal church. Objections to any location in Georgetown have been serious. Nevertheless, by frank discussion in open meetings, the objectors have become reconciled. Objections to the choice of the O Street site also were serious, but in this case leading business men finally took the position that the plant would improve rather than detract from the neighborhood.

ARCHITECTURE

Buildings at both plants have steel frames and red brick exteriors with limestone trim. At Georgetown the base is faced with granite. In keeping with the thought of incineration and flames a vertical treatment of pilasters and brick patterning was adopted, with the window lines carried across the spandrel beams by copper panels treated to imitate natural verdigris. This was followed also in the landscaping to the extent of grouping tall, pointed Douglas firs about the chimneys.

At each site the land purchased exceeded in area that covered by the building, to such a degree that effective landscape treatment could be provided as a setting for the building. The landscape designs were prepared by the office of Olmsted Brothers. At O Street, where the site is comparatively flat and contains a little less than three acres, the principal landscape features are the pointed firs mentioned above, a large recreation area and substantial open spaces among the trees and shrubs. The Georgetown plant is on a rugged hillside, which is planned to be emphasized by the planting and grading.

While an earnest attempt has been made to give the buildings and surroundings a dignified and pleasing appearance appropriate to the function of the plant, the primary consideration has been that of economy.

The chimneys may appear unduly thick, but this is because of the necessity for a refractory lining for their full height, with an air space for protection of the outer shell, and because of the large volume of the gases at the high temperatures encountered.

MATERIAL TO BE BURNED

The principal material to be burned is that known as municipal rubbish. Street sweepings also must be burned. Soil washed from unpaved streets and areas on to paved streets, and collected with the street sweepings, may result in the formation of slag in the furnaces and ash pits. The amount of soil collected in street sweepings in Washington today will be relatively small, due to the high proportion of permanent pavements; and it is hoped that with intelligent operation no trouble will be experienced from slagging.

In the autumn street sweepings in Washington include a volume of leaves which approximates the total volume of rubbish municipally collected. Analyses indicate that, following heavy rain, leaves have a moisture content about equivalent to that of garbage.

In dry weather the average moisture of Washington's municipally collected rubbish will approximate 5.5 per cent. Its average calorific value will be about 5,000 B. t. u. per pound as collected. The calorific value of the papers as collected in dry weather will run from, say, 5,400 to 7,600 B. t. u. per pound, and on the dry basis from 5,700 to 8,200 B. t. u. per pound.

In wet weather the rubbish when left standing out of doors and collected in open vehicles will absorb a high proportion of moisture.

TEMPERATURE CONTROL

With such a dry, loose and highly combustible fuel extremely high temperatures will be encountered, — in fact, temperatures which would be most damaging to the refractories, — unless properly controlled.

Provision is made for keeping the temperature of combustion within a safely low range by the admission of large volumes of overdraft air in excess of that required for combustion. Excess air admission ports are automatically controlled from the pyrometer thermocouples in the combustion chambers. They will be shut tight at and below a temperature

of 1400° F. and wide open at 1600°. Alarm bells will ring in the stoking aisle and the office, and a signal light will flash at the furnace in question, when the higher temperature is exceeded.

No air preheaters have been provided, but to assure that combustion will be completed within the combustion chambers during wet weather, auxiliary oil burners are provided in each furnace.



FIG. 3.—DUMPING FLOOR, BIN AND CRANE

OPERATING FEATURES

Collection vehicles enter the O Street dumping floor at one end, pass over a weighing platform, tip their contents into the receiving bin, and leave by the other end. The dumping floor is about 6 feet above street level. At Georgetown the entrance and exit both are at one end, at about street level. Weigh clerks' offices are beside the platforms at the entrances. In both cases the dumping floors are 35 feet wide and extend the entire length of the building. Receiving bins at the two plants have a capacity of 50,000 and 25,000 cubic feet, respectively.

Electric overhead cranes with grab buckets feed fuel to the charging hoppers on the top (or charging) floor. There are two cranes at

O Street and one at Georgetown. Each charging hopper spans across and terminates in three charging containers, each of about 1 cubic yard capacity. Charges of fuel are dropped through the furnace arches to the grates below, at frequent intervals, by manipulation, from the stoking floor, of compressed air operated gates.

In the furnace proper the rubbish is ignited, gases are distilled off, and combustion is started. The furnace chambers are 7.5 feet deep, 7 to 7.5 feet high and 18 feet long, separated into three cells each by division bars projecting a few inches above grate level. Gases flow across all cells, — the so-called mutual assistance principle, by which



FIG. 4. — GEORGETOWN INCINERATOR — STOKING AISLE

hot gases from one cell assist the ignition and combustion in another cell. No drying hearths are provided, but there is ample grate area to permit sufficient storage and drying of wet fuel. At the back of the end cell the gases roll over the bridge wall into the combustion chamber, where combustion is completed. The volume of the combustion chamber is two and one-third times that of the furnace proper. From the combustion chamber the gases pass into the flues through checker brick walls intended to ignite any pure carbon, in the form of charred paper, which may not have been burned and to stop the passage of fly ash. The floor of the flues is 3 feet above the floor of the combustion chamber, to provide a sump for collection of dust.

The flues from each furnace are joined by a cross flue outside the main building, through which the gases pass to the chimneys. At Georgetown there is only one chimney, 9 feet in inside diameter at the top, 150 feet high above the grate level and about 165 feet high above the bottom of the foundation, which rests on ledge rock. At O Street there are two chimneys, each 10 feet in inside diameter at the top and 120 feet high above grate level, resting upon pile foundations. Each chimney has an independently supported refractory lining for its full height, 13½ inches thick at the base at Georgetown and 9 inches at O Street.

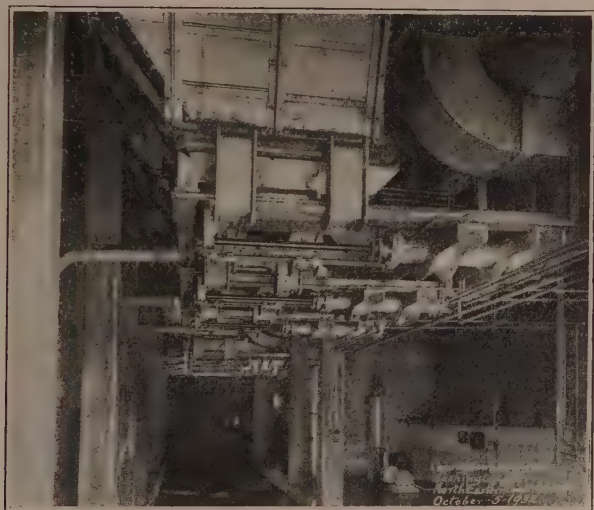


FIG. 5. — GEORGETOWN INCINERATOR — ASH TUNNEL

The furnace grates are provided with dumping sections 30 inches long by 15 inches deep, through which the ashes and incombustible residue, such as tin cans and other metal objects, are dumped to the ash pits below. Fires probably will be cleaned about twice per shift. Each cell has an independent ash pit with independent control of air for combustion.

Ash pits are lined completely with refractory tile and are provided with continuous quenchers and with air-tight, water-sealed ash removal gates. The gates are operated by oil pressure. At Georgetown large motor trucks receive ashes directly from the ash pits and haul them to the Foundry Branch dump west of Georgetown College. At O Street

ashes are dumped into an electric motor-operated trolley car which discharges into a semi-automatic vertical skip hoist at the south end of the ash tunnel. This hoist lifts the ashes into a storage bin of 5,000 cubic feet effective capacity and from this they are dropped into motor trucks for delivery to the Anacostia Park development for use as fill.

The furnace walls consist of $13\frac{1}{2}$ inches of fire brick bonded into 12 inches of red brick. On the exterior is a complete casing of steel $\frac{3}{16}$ inch thick. Similar construction is used for the flues inside the building, except that the linings are reduced to 9 inches in thickness.

Outside the buildings the outside steel casing of the flues is omitted, and a corrugated asbestos roof is provided. Where flues exceed 10 feet in height, the lower portion of the firebrick lining is $13\frac{1}{2}$ inches thick.

Suspended arches are used over all furnaces, the combustion chambers, and the flues for their entire length to the entrance of the chimney. Experience with sprung arches indicates, in general, that they are not so satisfactory as suspended arches, where the temperature changes are so sudden and great and the vibrations from charging equipment are so severe as in these incinerators.

Water-cooled dampers are provided on each furnace flue. These flues are 6 feet wide by 10 feet high inside, which makes their weight so great that counterweights and hand winches are provided for damper operation. When the dampers are lowered into the flues, water must circulate through them continuously.

The quenching water, and that which provides the water seals, flows through drains to individual sumps in the ash tunnel floor, the overflow from which flows through a main drainage trench to a large sump and thence to the sewer. Overflows from dampers are also discharged into this main trench.

Primary current at O Street is 2,300 volts, 3 phase, 60 cycles. It is stepped down to 230 volts for power use, by three 50 k. v. a. transformers, and to 115/230 volts for lighting by one 25 k. v. a. transformer. Transformers and appurtenant equipment are located in an underground vault. Motors at O Street have an aggregate capacity of a little over 300 horse power, and at Georgetown about 100 horse power.

Offices, toilet, locker and wash rooms are on the charging floor level (top story). Above these rooms there is an observation gallery for visitors, extending practically the full length of the building. At O Street another observation platform is provided by the roof over the weigh office. Boilers for steam heat and hot water, fired by oil, are located in separate rooms in the ash tunnel. Heat is available only in offices, toilet, locker and wash rooms and the compressor rooms.

Natural ventilation and lighting are provided to a large extent even in the stoking aisle by the arrangement of windows and doors. In addition, the air for forced draft can be drawn either from out of doors or from above the furnaces near the ceiling of the stoking room. Ash tunnel ventilation is provided by means of propeller fans mounted on and discharging directly through the building walls at the ends of the tunnels. Fresh air is drawn into the tunnels either from out of doors or from the top of the stoking room, by a suction duct. This duct is not connected with any fan. The tunnel itself acts as the connecting duct.

CONSTRUCTION

At O Street old maps indicated that an early shore line crossed the site. The filled ground and experience in pile driving at the sewage pumping station and the Navy Yard indicated the desirability of making a number of test borings. Concrete piles poured in place within a tapered, corrugated steel shell were used. It was found that these could not be driven to a depth greater than about 30 feet. Where greater lengths were required, shells of steel pipe were used. About 500 piles were used in all, and 44 under each chimney. The difference in elevation of the different parts of the structure added somewhat to the difficulties of pile driving.

At Georgetown the foundations generally were carried to rock, and considerable rock excavation was required.

Ready mixed concrete was used throughout at Georgetown and for the piles at O Street. All other concrete at O Street was mixed at the site.

About a million brick were used in both plants. Contractors were permitted to use brick made at the District of Columbia workhouse at Occoquan, Va., which were available at \$13 per 1,000 f. o. b. wharf in Washington. In both contracts commercial brick were used, because they could be purchased cheaper.

The contract time for construction at O Street was 270 days, and at Georgetown 260. Both plants are being finished well ahead of time. At Georgetown drying out fires were started on August 31, and at O Street recently.

Acceptance tests of equipment are now under way, and capacity tests of the furnaces at Georgetown will be started shortly, with those at O Street following thereafter.

The general contractors are the Rust Engineering Company of Pittsburgh for the O Street plant, and the North-Eastern Construction

Company of New York and Baltimore for the Georgetown plant. The furnaces at O Street were built by the general contractor and those at Georgetown by the Standard Arch Company of Frostburg, Md.

Both plants were built under the supervision of Mr. J. B. Gordon, Director of Sanitary Engineering, District of Columbia, with Mr. A. B. Greene, Resident Engineer.

Discussion

EDGAR S. DORR: Is any of the garbage burned in those incinerators?

MR. EDDY: That is not the intention. It will continue to be reduced and converted into grease and tankage at the garbage reduction plant twenty-five miles down the Potomac River. A good way to hold the temperatures down would be to put in wet garbage.

So far as the plants are concerned, there is no reason why a reasonable percentage of garbage could not be burned, in the proportion of two parts of garbage to one of rubbish.

MR. DORR: Would the temperature be high enough to prevent odors from garbage?

MR. EDDY: Yes, with reasonable proportions of garbage and rubbish.

QUESTION: What do you do with bottles, tin cans, etc.?

MR. EDDY: Tin cans go through unharmed except in appearance. The gloss on the outside is burned off, and they come out a light blue — the color of iron. The ashes sometimes would give one the impression that the fuel burned was hardly anything except tin cans. Bottles will melt. They may cause some trouble with slag. That is one reason why it may be of doubtful wisdom to use chain grates or traveling stokers. The wires and iron bands, such as are wrapped around barrels and orange crates, may result in the breaking of moving parts of a stoker. Chain stokers have been used a number of times, and the fingers break quite regularly. At Baltimore I think I was told that they broke about five hundred fingers in a year, only one or two a day. This is not serious because they can be replaced with the plant still in operation; but there the rubbish was sorted and salvaged, so the harmful materials could be removed.

QUESTION: How much of the rubbish is useful as fuel?

MR. EDDY: From the best information we have in the city of Washington, from a careful sampling extending over a period of nearly a year, the indications are that about 23 or 24 per cent of the material going to the plant is incombustible, and on top of that there is a residue

of material that does not burn. I think the total residue will run not far from 30 per cent of the material going to the plant.

QUESTION: About what will the flue gas analysis be?

MR. EDDY: Largely excess air. The steam power plant man strives to hold down his excess air, while in these plants we strive to increase it in order to hold down the temperatures.

QUESTION: I think you said that 30 per cent by weight of the incoming material goes out as residue. How much would this mean in bulk?

MR. EDDY: The bulk would be greatly reduced. Much more than 30 per cent, I think. I do not believe I can say yet just how much the bulk is reduced, but it is reduced substantially, and the appearance has changed much from the original material.

RALPH HORNE: What would this 300 pounds per capita per year mean in cubic feet, as dumped from the wagon?

MR. EDDY: The material weighs on the average about 225 pounds per cubic yard. The average American citizen produces a little less than one cubic yard a year. In Washington it is a bit more than a yard a year. There are private collectors in Washington who contribute about a cubic yard of combustible rubbish per capita per year.

QUESTION: Was the plant designed for twenty-four hour operation?

MR. EDDY: Yes.

QUESTION: What is the capacity of the storage bin?

MR. EDDY: About twenty-four hours' capacity, if I recall correctly.

QUESTION: Is the delivery on an eight hour basis?

MR. EDDY: The collection day is eight hours, but all deliveries arrive at the plant in a shorter time.

QUESTION: How about truck capacity?

MR. EDDY: The old trucks had a capacity of 26 cubic yards; the new ones, 20 cubic yards.

QUESTION: What is the purpose of the water seal?

MR. EDDY: To provide an air-tight ash tunnel, so that when the ashes or residue are dropped into the ash tunnel the dust and smoke will not be blown out into the working space. The water seal is provided by a continual flow of water. The quenching water quenches and cools the ashes.

MR. DORR: No coal ashes are brought to this plant?

MR. EDDY: Only such as may come surreptitiously in the rubbish. Ashes are collected separately and are disposed of on the dumps.

OF GENERAL INTEREST

MEMOIRS

Herbert Neal Cheney *

DIED SEPTEMBER 12, 1928

HERBERT NEAL CHENEY was born in Lynn, March 17, 1876, the son of John Eugene Cheney and Ellen Maria Neal.

He attended the English High School of Boston. Upon graduation from the Lawrence Scientific School, Harvard University, in 1899, he went to work immediately as draughtsman for the Boston Gas Light Company, and remained with the same company and its successor, the Boston Consolidated Gas Company, up to the time of his death. In the course of this employment he occupied various offices, as assistant superintendent in some of the plants, then successively as superintendent, engineer of construction, engineer in charge of manufacture and construction, and vice-president and chief engineer.

Mr. Cheney was a member of the American Society of Civil Engineers, the Boston Society of Civil Engineers, New England Gas Association (President in 1925-26), De Molay Commandery, Knights Templars, and other Masonic bodies. He took a lively interest in local affairs and was a member of the Savin Hill Improvement Association and the Savin Hill Yacht Club. During the police strike in Boston he enlisted in the Massachusetts State Guard, First Motor Corps.

On November 21, 1900, he married

Bertha Riggs Mawson. He is survived by her and by two children, Josephine (1901, now Mrs. Raymond Presbrey) and John Eugene (1909), and by a granddaughter, Jean Presbrey.

He was a member of the First Parish Church, Dorchester, also a member of the Richard Mather Chapter of Laymen's League.

Mr. Cheney died September 12, 1928. In his death the community and the profession lost a valuable and highly esteemed member.

Edwin Howland Lincoln †

DIED DECEMBER 8, 1929

EDWIN HOWLAND LINCOLN was born in Boston, Massachusetts, on January 14, 1854. He was the son of Albert L. and Ann E. (Stoddard) Lincoln.

Mr. Lincoln was a member of the Class of 1875, Massachusetts Institute of Technology. After leaving the Institute he was employed by the United States Coast and Geodetic Survey, and was assigned to survey work in the Caribbean Sea.

In 1877 he entered into partnership with Thomas Aspinwall, a classmate, under the name of Aspinwall & Lincoln. In the first years of the partnership Aspinwall & Lincoln had charge of building roads through the property of the Aspinwall Land Company in Brookline.

In 1886 the firm was engaged to make surveys for the widening of Beacon

* Memoir prepared by Edgar S. Dorr, M. B. S. C. E.

† Memoir prepared by Louis A. Chase, M. B. S. C. E.

Street through Brookline from a width of 50 feet to 160 feet, and later had full charge of the construction of the street and the necessary drains and sewers.

Among the projects for which Aspinwall & Lincoln acted as engineers were the development of Longwood, north and south of Beacon Street; the Corey Hill, Corey Farm, and West End Land Company sections; the Forbes Estate in Milton; Court Park in Winthrop; Charles River Embankment in Cambridge; Peters Estate in Forest Hills; and the Park Square District in Boston. They also made the complete surveys for the United States Naval Magazine in Hingham and Weymouth; surveys of all Harvard College land in Cambridge and Boston; and survey for new Stuart Street in Boston.

Aspinwall & Lincoln made surveys for most of the large buildings in Boston. Among the first was the Exchange Building at 53 State Street, and the last, prior to Mr. Lincoln's death, was the building at 75 Federal Street.

Mr. Lincoln was engineer of a section

of the Bath, Maine, housing project for the United States government during the World War.

Mr. Aspinwall died in 1918, and in 1926 Mr. Lincoln formed a partnership with William S. Crocker which continued until Mr. Lincoln's death, since which time the business has been conducted by Mr. Crocker.

Mr. Lincoln was a member of the Boston Society of Civil Engineers, the Boston Art Club, and the Cohasset Golf Club. As an actor with the old Brookline Comedy Club he afforded much pleasure and amusement to many audiences. He was an enthusiastic golfer.

Mr. Lincoln was unusually conscientious in all his work, and was a genial optimist who had the respect and affectionate regard of all who knew him.

In 1876 he married Isabelle Anderson of Lowell. He is survived by three sons and one daughter.

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

Boston Society of Civil Engineers

DECEMBER 21, 1932. — A regular meeting of the Boston Society of Civil Engineers was held this evening at the Engineers Club, and was called to order by the President, Ralph W. Horne. The attendance was seventy-five.

Announcement was made of the death of William A. Johnson, who died on December 20, 1932, and had been a member since May 19, 1920.

The Secretary reported that the follow-

ing had been elected by the Board of Government on December 21, 1932:

Grade of Student Membership: Manuel Albert Benson, Howard W. Davis, Charles M. Kelley, Alfred H. Lewis, Virgil D. Maguire, George McElhiney, Paul S. McKinnon, Howard C. Neilson, George A. Papantonion, Albert Seppala, Gail P. Edwards, Warren M. Campbell, Francis H. Dutra, Irving W. Kendall, Edward F. Locke, Frederick J. Martin, Augustus P. McGuckian, Leslie J. Meszaros, Bernard Noden, C. Frederick Peoples, Alan K. Willard.

Mr. R. M. Boynton, Assistant Engi-

neer, Robinson & Steinman, Consulting Engineers, New York City, gave a talk, illustrated by lantern slides, on the "Design and Construction of the Waldo-Hancock Bridge." This bridge, of the high level, suspension type, crosses the Penobscot River at Bucksport, Me., joining the counties of Waldo and Hancock.

The meeting adjourned at 8.45 P.M.
EVERETT N. HUTCHINS, *Secretary*.

Designers Section

DECEMBER 14, 1932. — The meeting of the Designers Section was called to order by the Chairman at 6.00 P.M. in the rooms of the Engineering Societies of Boston.

The minutes of the November meeting were read and approved.

Mr. Ropes introduced the speaker, Mr. Arthur Schweier, whose subject was "Some Fundamentals of Public Utility Valuation." Mr. Schweier discussed the fundamentals of appraising property and outlined the successive steps to be taken in arriving at the value of a public utility.

After an interesting discussion in which many took part, the meeting adjourned at 7.45 P.M.

Thirty-one members and guests were present.

HERMAN G. DRESSER, *Clerk*.

APPLICATIONS FOR MEMBERSHIP

[January 20, 1933.]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the

Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

For Admission

HAMILTON, FRANCIS WIMON, Brookline, Mass. (Age 47, b. Somerville, Mass.) Experience: two and one-half years with Harrison L. House, C.E., on general surveys; ten years with Henry F. Bryant & Son, eight years as chief, hydroelectric developments, general construction and surveys; eighteen years as construction engineer with James Driscoll & Son, Inc., Brookline; member of firm, and vice-president for past ten years, and am so at present. Refers to *O. D. Allen, D. M. Pratt, G. A. Sampson, R. H. Whiting, H. A. Varney*.

MOHR, HENRY A., Waban, Mass. (Age 47, b. Fowler, Ind.) Graduate of Purdue University, with degrees B.S. and M.E., 1907. Engaged in engineering work ever since that date, and at present as manager of New England District for The Gow Company, Inc., Raymond Concrete Pile Company. Refers to *Arthur Casagrande, J. S. Crandall, C. R. Gow, J. A. Tomassello*.

For Transfer from Grade of Junior

DAVIS, ALMON CHARLIE, West Burke, Vt. (Age 26, b. Charleston, N. H.) Graduate of Northeastern University, with degree B.C.E., in 1929. During co-operative periods was employed by Vermont State Highway Department as transitman and draftsman; from June, 1929, to November same year was assistant to steel workers with the Kitteredge Bridge Company of Concord, N. H.; January to April, 1930, as rodman with Boston & Maine Railroad; April to July, 1930, assistant engineer for contractor, Sanders Engineering Company, Portland, Me., on earth dam, Fifteen Mile Falls project; July to October, 1930, as labor and shovel

foreman for Miller Brothers Construction Company on road construction; October, 1930, to February, 1931, as labor and shovel foreman for Greenleaf Construction Company; from May, 1931, to date, as engineer and timekeeper on road construction projects with the Vermont State Highway Department. Refers to *W. J. Alcott, H. B. Alvord, W. H. Chase, W. E. Nightingale.*

KELLY, HAROLD W., New York, N. Y. (Age 29, b. Roxbury, Mass.) Graduate of Northeastern University, with degree B.C.E. During the co-operative periods was employed by Aspinwall & Lincoln as rodman and transitman; after graduating, with the Pan American Petroleum and Transport Corporation as resident engineer on construction of terminal; with Metcalf & Eddy for one month in 1926; since that time to date with The Texas Company as plant engineer, construction, and assistant superintendent; since June, 1931, has been in the refining department of this company assisting with engineering operating and personnel audits at plants throughout the United States. Refers to *H. B. Alvord, H. H. Crossman, C. S. Ell, W. E. Nightingale.*

DEATH

WILLIAM A. JOHNSON . Dec. 20, 1932

ADDITIONS

Student Members

JAMES N. DE SERIO, 114 Huntington Avenue, Boston, Mass.

GAIL P. EDWARDS, 28 Langdon Street, Cambridge, Mass.

NEIL B. FAUNCE, 105 North Avenue, North Abington, Mass.

CARL H. M. JOHNSON, 121 Henry Avenue, Lynn, Mass.

IRVING W. KENDALL, 200 Pleasant Street, Stoughton, Mass.

PHILIP J. LACAVA, 303 White Street, Hartford, Conn.

ANGELO MASSA, 86 Park Street, Beverly, Mass.

ELFORD H. RICHARDSON, 247 Kent Street, Brookline, Mass.

A. BRUCE SCHOW, 25 Edwin Street, Stratford, Conn.

WALTER F. WOLFRUM, 16 Dalrymple Street, Jamaica Plain, Mass.

BOSTON SOCIETY OF CIVIL ENGINEERS

FOUNDED 1848

INDEX TO ADVERTISERS

	PAGE
ALGONQUIN ENGRAVING CO., INC., 18 Kingston St., Boston	iv
ASPINWALL & LINCOLN, 46 Cornhill, Boston	ii
BARBOUR, FRANK A., Tremont Building, Boston	iii
BARROWS, H. K., 6 Beacon St., Boston	ii
BLACK & BLUE PRINT CO., 71A Pearl St., Boston	vi
BLAKESLEE, ROLLINS CORPN., 6 Beacon St., Boston	iii
BRUNO & PETITTI, CONTRACTORS, 18 Tremont St., Boston	iv
BRYANT, HENRY F., & SON, 334 Washington St., Brookline	iii
BUFF & BUFF CO., Jamaica Plain	v
CINDER CONCRETE UNITS CORPN., 201 Devonshire St., Boston	vi
COLEMAN BROS., 245 State St., Boston	iv
CRANDALL ENGINEERING CO., 134 Main St., Cambridge	vi
ELLIS, W. H., & SON CO., East Boston	iv
FAY, SPOFFORD & THORNDIKE, 44 School St., Boston	ii
FULLER & MCCLINTOCK, 170 Broadway, New York	ii
GOW COMPANY INC., 956 Park Square Building, Boston	vi
HAWKRIE BROTHERS CO., 303 Congress St., Boston	iv
HOLZER, U., INC., 333 Washington St., Boston	iv
HUGHES, EDWARD F., 53 State St., Boston	v
HUTCHESON COMPANY, INC., 36 Bromfield St., Boston	v
JACKSON & MORELAND, Park Square Building, Boston	ii
KIMBALL CO., RICHARD D., 6 Beacon St., Boston	iii
MAIN, INC., CHAS. T., 201 Devonshire St., Boston	iii
MAKEPEACE, INC., B. L., 387 Washington St., Boston	Back cover
MANEY, C. J., CO., INC., 50 Congress St., Boston	v
METCALF & EDDY, Statler Building, Boston	ii
MOORE, LEWIS E., 73 Tremont St., Boston	ii
NEW ENGLAND FOUNDATION CO., INC., 38 Chauncy St., Boston	iv
NEW ENGLAND POWER ENGINEERING & SERVICE CORPN., 89 Broad St., Boston	iv
NORTHERN STEEL COMPANY, 44 School St., Boston	iv
PACKARD, GEORGE A., 50 Congress St., Boston	iii
PITTSBURGH TESTING LABORATORY, 101 Tremont St., Boston	iii
REIDY, MAURICE A., 44 School St., Boston	iii
RENDLE, ROY B., & CO., 322 Border St., East Boston	iv
SIMPSON BROS. CORPN., 77 Summer St., Boston	v
SKILLMAN & SUNDERLAND CO., 1042 Little Building, Boston	iv
SOMERSET PRINTING CO., 470 Atlantic Ave., Boston	iv
THOMPSON & LIGHTNER, THE, CO., INC., 702 Beacon St., Boston	ii
TOMASELLO, A. G., & SON, 250 Stuart St., Boston	v
TRIMOUNT DREDGING CO., 10 State St., Boston	iii
TURNER, HOWARD M., 12 Pearl St., Boston	ii
WESTON & SAMPSON, 14 Beacon St., Boston	ii
WHITMAN & HOWARD, 89 Broad St., Boston	ii
WOLF, EZEKIEL, 10 State St., Boston	iii
WORCESTER, J. R., & CO., 79 Milk St., Boston	ii
WRIGHT & POTTER PRINTING CO., 32 Derne St., Boston	v

LEWIS E. MOORE*Consulting Engineer*73 TREMONT STREET
BOSTON, MASS.**ASPINWALL & LINCOLN**

(WILLIAM S. CROCKER)

Civil Engineers

46 CORNHILL, BOSTON

FAY, SPOFFORD & THORNDIKE**Consulting Engineers**

Investigations	Reports	Designs
Engineering Supervision		Valuations
Port Developments		Fire Prevention
Bridges	Buildings	Foundations
	Water and Sewerage Systems	

44 SCHOOL STREET, BOSTON

FULLER & McCLINTOCK**Engineers**

GEORGE W. FULLER	JAMES R. McCLINTOCK
F. G. CUNNINGHAM	ELMER G. MANAHAN
C. A. EMERSON, JR.	W. DONALDSON
E. W. WHITLOCK	

Water Supply, Water Purification, Sewerage,
Sewage Disposal, Garbage and Industrial
Wastes Problems, Valuation and Rate
Regulation of Public Utilities

NEW YORK -- 170 BROADWAY

H. K. BARROWS*Consulting Hydraulic Engineer*

Water Power, Water Supply, Sewerage,
Drainage. Investigations, Reports, Valua-
tions, Designs, Supervision of Construction

6 BEACON ST. BOSTON, MASS.

METCALF & EDDY**Engineers**

Harrison P. Eddy	John P. Wentworth
Charles W. Sherman	Harrison P. Eddy, Jr.
Almon L. Fales	Arthur L. Shaw
Frank A. Marston	E. Sherman Chase

Water, Sewage, Drainage, Garbage and
Industrial Wastes Problems

Valuations	Laboratory
STATLER BUILDING	BOSTON, MASS.

THE THOMPSON & LIGHTNER CO., INC.BOSTON **Engineers** CHICAGO

Designs and Engineering Supervision
Investigations, Testing and
Inspection of Structural Materials
Concrete Quality Control
Marketing and Production Service

Research Laboratory, 702 BEACON ST., BOSTON, MASS.

HOWARD M. TURNER*Consulting Engineer*

Investigations, Valuations, Plans,
Supervision of Construction, Water
Power, Water Supply, Public Utility
and Industrial Properties

12 Pearl Street : : : Boston

WESTON & SAMPSON

ROBERT SPURR WESTON G. A. SAMPSON

Laboratory for the Analysis of Water.
Sewage, Filtering Materials, etc., Design
Inspection and Supervision of Water Puri-
fication and Sewage Disposal Plants.

14 BEACON STREET, BOSTON. MASS.

WHITMAN & HOWARD**CIVIL ENGINEERS**

(EST. 1869. INC. 1924)

Investigations, Designs, Estimates, Reports
and Supervision in all Water Works, Sewerage,
Drainage, Waterfront Improvements and all
Municipal or Industrial Development Problems.

89 Broad Street Boston, Mass.

J. R. WORCESTER & CO.**Engineers**

BUILDINGS BRIDGES FOUNDATIONS
STEEL AND REINFORCED CONCRETE
DESIGNS INVESTIGATIONS
EXPERT TESTIMONY
CEMENT AND SAND TESTING

79 MILK STREET BOSTON, MASS.

JACKSON & MORELAND**Engineers**

BOSTON NEW YORK

CHAS. T. MAIN, Inc.

ENGINEERS

201 DEVONSHIRE ST. -- BOSTON, MASS.

*Industrial Building Design — Steam
and Hydraulic Plants — Engineering
Consulting Engineering*

CHARLES T. MAIN
F. M. GUNBY
HARRY E. SAWTELL
W. F. UHL

CHARLES R. MAIN
A. W. BENOIT
MARCUS K. BRYAN
R. A. MONCRIEFF

H. F. BRYANT & SON

Consulting Engineers

CIVIL - ARCHITECTURAL - LANDSCAPE

334 WASHINGTON STREET

BROOKLINE

MAURICE A. REIDY

Consulting Engineer

STRUCTURAL DESIGNS FOUNDATIONS

44 SCHOOL STREET

BOSTON, MASS.

TRIMOUNT DREDGING COMPANY

10 STATE STREET

BOSTON

HERBERT T. GERRISH
PRESIDENT

Blakeslee Rollins Corporation

CONTRACTORS

6¹/₂ Beacon Street Boston, Mass.

Foundations of all kinds

Wharves and Dock Construction

D. A. BLAKESLEE, President

CLARENCE BLAKESLEE, Vice-President

J. W. ROLLINS, Vice-President and Treasurer

WALTER G. CHEEVER,
General Superintendent

Telephone, Lafayette 4869

RICHARD D. KIMBALL CO.

Consulting and Designing Engineers

Mechanical, Electrical and Sanitary

6 BEACON STREET

BOSTON, MASS.

FRANK A. BARBOUR

Consulting Engineer

*Water Supply, Water Purification
Sewerage and Sewage Disposal*

Tremont Building, Boston, Mass.

GEORGE A. PACKARD

**MINING . .
ENGINEER**

EXAMINATIONS AND REPORTS

*Supervision of Exploration, Purchase,
Development and Operation*

50 CONGRESS STREET, BOSTON

EZEKIEL WOLF

Reg. Patent Attorney and Engineer
Counsellor at Law

Patent and Trade - Mark Causes

Consultation by Appointment

10 STATE ST., BOSTON, MASS.

Telephone Capitol 3999

Pittsburgh Testing Laboratory

**Inspection Testing Analysis
Research**

Boston Office - 101 Tremont St.

Branch Offices in the Principal Cities

ARCHITECTURAL STAINLESS STEELS

are a specialty of

HAWKRIDGE BROTHERS CO.
303 Congress Street, Boston, Mass.

New England Foundation Co., Inc.
Engineering and Construction

Simplex Concrete Piles

Caissons — Difficult Foundations

38 CHAUNCY STREET BOSTON, MASS.

COLEMAN BROS., Inc.

General Contractors and Builders

Main Office
245 STATE STREET, BOSTON
HUBBARD 4880

NORTHERN STEEL COMPANY

44 SCHOOL STREET, BOSTON

Concrete Reinforcing Bars

WORKS AT
GLENWOOD STATION, MEDFORD, MASS.

Compliments of
New England Power Engineering
& Service Corporation

Telephone 0490 East Boston

ROY B. RENDLE & CO., Inc.
Pile Driving, Wharf and Bridge Building
322 BORDER STREET
EAST BOSTON
ROY B. RENDLE, General Manager

Dredging Pile Driving
Sea Wall and Bridge Building
Submerged Pipe and Foundations

W. H. ELLIS & SON COMPANY
EAST BOSTON, MASSACHUSETTS

SKILLMAN & SUNDERLAND CO.
1042 LITTLE BUILDING, BOSTON, MASS.

Representing
UNITED METAL PRODUCTS CO.
CANTON, OHIO
Manufacturers of
Hollow Metal Doors, Trim, Base, etc.

BRUNO & PETITTI

CONTRACTORS

WATERWORKS, SEWERS, HIGHWAYS AND
CONCRETE CONSTRUCTION

18 Tremont Street Boston, Mass.

Somerset Printing Co.

COMMERCIAL PRINTING

ENGRAVING . PLATE PRINTING
RELIEF PRINTING : EMBOSHING

470 ATLANTIC AVENUE, BOSTON
TELEPHONE - - - - - LIBERTY 3925

PHOTO ENGRAVERS
COLOR PLATES - HALF-TONES
LINE PLATES

ALGONQUIN
ENGRAVING CO. Inc.
18 Kingston Street, Boston, Mass.
Tel. HAN 4855

U. HOLZER, Inc.

BOOKBINDER

333 Washington Street (Opp. Milk Street)
Or 24 Province Street Main Shop at Hyde Park
Books Bound, Charts Mounted, Portfolios,
Lettering, Photographs Mounted



TRANSITS AND LEVELS

*World Famous
for 71 Years*

GEORGE L. BUFF
LOUIS F. BUFF
HENRY A. BUFF
WILL J. BUFF
WILL J. BUFF, Jr.

BUFF PRECISION
is continuously in the
forefront



All Makes Repaired
at Reasonable Cost

Buff & Buff Co.

Jamaica Plain,
Mass.

C. J. MANEY CO., Inc.
General Contractors

JOSEPH MANEY, *President*



CONGRESS STREET BOSTON

SIMPSON BROS. CORPORATION

Engineers and Contractors
for

Reinforced Concrete Construction

Asphalt, Concrete and Vulcanized
Pavements

A. G. TOMASELLO & SON, INC. Contractors

*Steam Shovel Excavating, Foundations
and Public Works*

250 STUART STREET - BOSTON, MASS.
TELEPHONE HANCOCK 7270

JOS. A. TOMASELLO, Pres. and Treas.

Specialists on Reproduction
BLUE PRINTS, PHOTOSTAT PRINTS,
BLACK-LINE PRINTS, PLANOGRAPH PRINTS,
DRAWING SUPPLIES AND EQUIPMENT

HUTCHESON COMPANY, INC.

36 BROMFIELD STREET, BOSTON

Tel. LIBerty 1467-1468
Branch Exchange connecting All Departments

EDWARD F. HUGHES

Waterworks Contractor

Public and Private Water Supply

Artesian and Driven Wells

Foundation Borings

53 State St. Room 1102 Boston

Wright & Potter Printing Company

COMMERCIAL PRINTERS

32 Derne Street - Boston, Mass.

Tel. Capitol 2000, 2001, 2002

THE CRANDALL ENGINEERING COMPANY

CONSULTING AND
CONSTRUCTING ENGINEERS

DESIGN of Floating, Basin, and Railway Dry Docks,
Wharves, Piers, Bridges, etc.

CONSTRUCTION of these and other Engineering
Structures

134 MAIN STREET, CAMBRIDGE, MASS.

FOUNDATIONS

ENGINEERS AND CONTRACTORS

The Gow Company Inc.

956 Park Sq. Building
Boston

GOW CAISSONS
RAYMOND CONCRETE PILES
SOIL TEST BORINGS

90 WEST ST., NEW YORK CITY

111 W. MONROE ST., CHICAGO

REPRODUCTIONS

On Tracing Cloth or Paper by Gelatine Lithograph Process

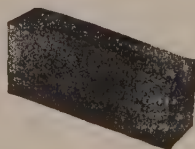
BLUE PRINTS

BLACK & BLUE PRINT COMPANY

242 PURCHASE STREET, BOSTON

CINUCOR MASONRY UNITS

ARE LIGHT,
TOUGH AND
STRONG



*Used where fire safety
sound-proofness, and in-
sulation are essential.*

CINDER CONCRETE UNITS CORPORATION, 201 Devonshire Street, Boston, Mass.

Please mention the Journal when writing to Advertisers

COMMITTEES

NOMINATING COMMITTEE

Past Presidents (Members of the Committee)

CHARLES M. ALLEN

FRANK A. MARSTON

CHARLES B. BREED

HENRY B. ALVORD
CHARLES W. BANKS
GEORGE E. HARKNESS
(Term expires March, 1933)

W. W. BIGELOW
ERWIN HARSCH
W. D. HENDERSON
(Term expires March, 1934)

SPECIAL COMMITTEES

Program

RALPH W. HORNE, *Chairman, ex officio*

JOHN B. BABCOCK, 3d
WILLIAM W. BIGELOW
HARRY P. BURDEN
E. SHERMAN CHASE
LUZERNE S. COWLES

HOWARD A. GRAY
EVERETT N. HUTCHINS
WILLIAM J. KEEFE
KARL R. KENNISON
HARVEY B. KINNISON

CHARLES R. MAIN
JAMES H. O'CONNOR
HOWARD M. TURNER
EDWARD WRIGHT

Publication

EVERETT N. HUTCHINS, *Chairman*

HAROLD K. BARROWS
FRANK W. GILCREAS
F. WM. HALEY
ARTHUR J. HARTY

LEROY M. HERSUM
HERBERT D. HURLEY
RAY H. LINDGREN

RALPH E. RICE
TRUMAN H. SAFFORD
JOHN P. WENTWORTH

Library

HENRY B. ALVORD, *Chairman*

EDWARD S. AVERELL
HARRISON P. EDDY, JR.
ALBERT HAERTLEIN

ERWIN HARSCH
WALDO F. PIKE

KENNETH C. REYNOLDS
FREDERIC N. WEAVER

Subsoils of Boston

HARRY E. SAWTELL, *Chairman*

J. STUART CRANDALL
IRVING B. CROSBY
CARROLL A. FARWELL

HEYWARD S. FRENCH
CHARLES D. KIRKPATRICK

CHARLES W. ROBINSON
ALBERT C. TITCOMB

Social Activities

RICHARD W. SHEERMAN, *Chairman*

EDWARD S. AVERELL
JOHN J. CAMPOBASSO
HUGH D. CHASE
WILLIAM H. FITZGERALD

RICHARD H. HAMILL
JOHN H. HARDING
A. ALBERT MINICHIELLO

ARTHUR W. PETERSON
ALFRED T. STAMP
LEON B. TURNER

Membership and Publicity

ARTHUR L. SHAW, *Chairman*

GEORGE G. BOGREN
HERBERT S. CLEVERDON
ATHOLE B. EDWARDS

JOHN F. GERMAINE
WILLIAM D. HENDERSON
FRANK L. LINCOLN

JOHN F. PIERCE
WALTON H. SEARS
WALTER C. VOSS

Relation of Sections to Main Society

JOHN B. BABCOCK, 3d, *Chairman*

S. E. COBURN
ARTHUR W. DEAN
GORDON W. FAIR

JOHN B. KOMICH
FRANCIS T. MCAVOY

L. G. ROPES
HENRY C. SHEILS

Registration and Licensing of Engineers

CHARLES B. BREED, *Chairman*

RICHARD K. HALE

FRANK E. WINSOR

Research

FRANK A. MARSTON, *Chairman*

H. K. BARROWS
THOMAS R. CAMP
J. STUART CRANDALL

A. B. EDWARDS
ALBERT HAERTLEIN

HARRY E. SAWTELL
FRANK B. WALKER

Run-off

ARTHUR T. SAFFORD, *Chairman*

HARRY P. BURDEN
ARTHUR C. EATON
HENRY GOODNOUGH
WILLIAM D. HENDERSON
RALPH W. HORNE
S. STANLEY KENT

H. B. KINNISON
WILLIAM A. LIDDELL
R. R. MARSDEN
WILLIAM NOYES
L. B. PUFFER

CALEB MILLS SAVILLE
HOWARD M. TURNER
WILLIAM F. UHL
ARTHUR D. WESTON
FRANK E. WINSOR

Welfare

ARTHUR W. DEAN, *Chairman*

STUART E. COBURN
FRANCIS H. KINGSBURY

FRANCIS T. MCAVOY
LAWRENCE G. ROPES

John R. Freeman Fund

CHARLES T. MAIN, *Chairman*

CHARLES M. ALLEN

ROBERT SPURR WESTON

HOWARD M. TURNER

Desmond FitzGerald Award

CARROLL A. FARWELL, *Chairman*

GEORGE E. HARKNESS

C. FREDERICK JOY, JR.

Board of Reference

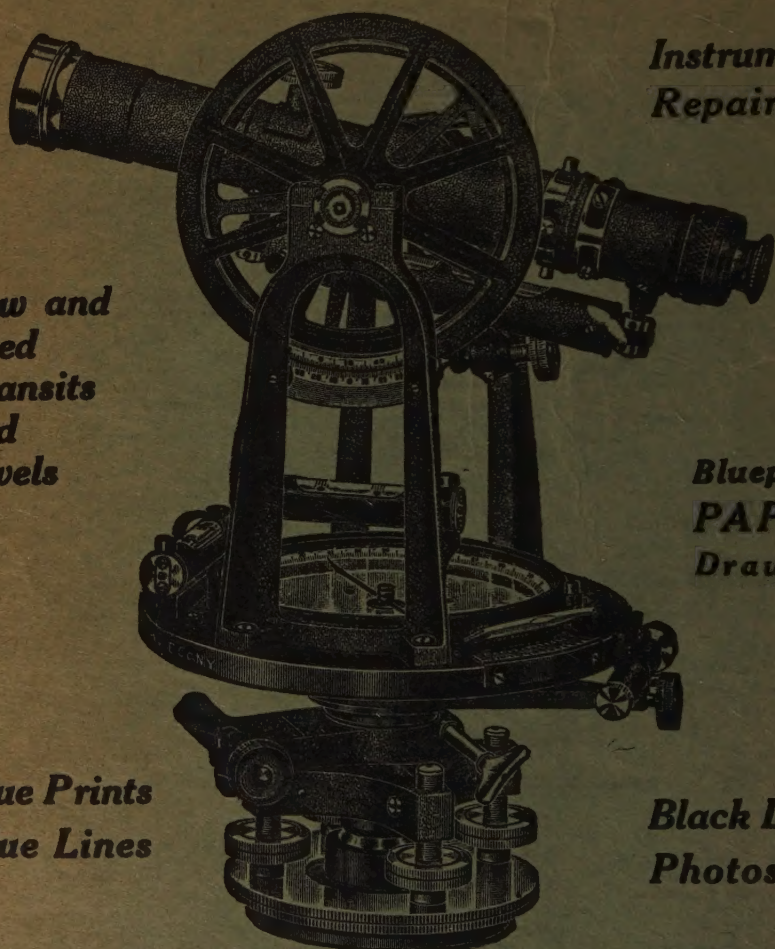
EUGENE E. PETTEE, *Chairman*

EDWARD S. LARNED

MARK LINENTHAL

CHARLES R. MAIN

**Field and Office Equipment and Supplies
FOR THE ENGINEER**



**Instrument
Repairing**

**New and
Used
Transits
and
Levels**

**Blueprint
PAPER
Drawing**

**Blue Prints
Blue Lines**

**Black Lines
Photostats**

DRAFTING ROOM FURNITURE

B. L. MAKEPEACE, Inc.

387 WASHINGTON STREET, - 462 BOYLSTON STREET

Including H. H. SULLIVAN, INC., successors to FROST & ADAMS CO.,

BOSTON, MASS.